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Fourth-Generation Fighters: Addressing the Asymmetric Threats Facing Our Homeland Defense

by

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ABSTRACT

The purpose of this research paper is to acknowledge the asymmetric threats posed against the United States and identify ways fourth-generation fighter aircraft can continue to fulfill the Aerospace Control Alert (ACA) homeland defense mission. Opposing state and non-state actors have realized that asymmetric warfare poses the greatest challenges to the United States and its allies. Tasked to mitigate threats posed by ballistic missile proliferation, unmanned systems, and weapons of mass destruction (WMDs), civilian and military leaders question the fourth-generation fighter aircraft's ability to counter these threats. Implementing the problem/solution framework, this paper investigates four alternatives to bridge the fourth-generation to fifth-generation fighter gap for aircraft assigned to ACA sites conducting homeland defense missions. The alternatives include: implementing a Service Life Extension Program (SLEP) for existing fourth-generation aircraft, purchase new fourth-generation aircraft, purchase ACA mission specific aircraft tailored to fulfill homeland defense missions, and assign ACA as a unit's primary mission. The results of this research paper reveal that a decreased deployment cycle for ACA assigned units and investment towards the modernization of fourth-generation fighter aircraft, the United States can properly fulfill the ACA mission and mitigate asymmetric threats challenging our homeland defense.

Section I – Introduction

For many years, the United States national security challenges were limited to overseas conflicts, rarely presenting credible threats against the American people. The 11 September 2001 terrorist attacks (9/11), however, taught the United States a valuable lesson: the enemies of the U.S. continually seek to bring the fight to U.S. shores. The 9/11 attacks also revealed that the United States 'No-Fail' homeland defense mission was not prepared for asymmetric attacks. This was evidenced by the destruction of buildings, a large number of civilian casualties, and a collective concern for well-being among the American people. As a result, many fourth-generation fighter aircraft were assigned to alert postures around the United States in an attempt to respond in the event of other similar attacks to our homeland defense. Approaching twenty years since the 9/11 terrorist attacks, many homeland defense subject matter experts suggest that our current fleet of fourth-generation fighter aircraft will not provide a reasonable level of protection against future asymmetric attacks.[1]

Background

The mission of homeland defense dates back to the founding of the United States. Colonial militias, consisting of volunteer citizen-soldiers, were trained to react to threats posed against their respective colony where regular Federal military was not in a position to react immediately.[2] Whether defending against offensive invasion from traditional armies or defending against smaller nontraditional threats posed by foreign and domestic aggressors, the National Guard has a long standing tradition of helping ensure our nation's homeland defense.[3]

Homeland defense missions today are found throughout the domains of air, land, maritime, space, and most recently cyberspace. Regardless of each domain's involvement in the homeland

defense mission, the Department of Defense (DoD) is continually making advancements and reductions in each domain's involvement due to the perceived threats evolving and changing. For example, an estimated 5,800 aircraft were placed on alert in the late 1950s in order to defend against a strategic attack from the Soviet Union.[4] By 2001, only 14 interceptor aircraft were positioned on alert in the United States due to the reduced symmetric threat posed by Russia and other countries. This reduction in force would expose a vulnerability against asymmetric threats posed by nontraditional aggressors as evidenced by the 9/11 terrorist attacks.[5]

As a result of the 9/11 attacks, the DoD reaffirmed that protecting the United States homeland is the highest priority and initiated Operation NOBLE EAGLE (ONE).[6] ONE and the 2005 Strategy for Homeland Defense and Civil Support provided the North American Aerospace Defense Command (NORAD) with the tools and authority necessary in order to increase their responsibilities beyond the symmetric threats posed by other countries. This resulted in NORAD's ability to properly focus on increasing asymmetric threats and protect the airspace against air threats that originate within or near the United States.[7]

Today, the Air Force is responsible for providing all of the aircraft in support of ONE. Placed under the Aerospace Control Alert (ACA) mission, 16 maintained alert sites are currently in place to protect the United States against foreign and domestic threats twenty-four hours a day, seven days a week. These aircraft positioned at ACA sites consist of approximately 75% fourth-generation fighter aircraft and 25% fifth-generation fighter aircraft. The category of fourth versus fifth-generation is graded by an aircraft's avionic and maneuvering capabilities. For instance, fourth-generation fighter aircraft are those produced during the late 1970s through the late 1990s. Some examples of fourth-generation aircraft include: F-14, F-15, F-16, and the F-18. Fifth-

generation fighter aircraft consist of the F-22 and F-35. Sixth-generation fighter aircraft will likely be the next fighter aircraft the United States produces.

Problem

Of these 16 alert sites, 14 are maintained and operated by the Air National Guard. These units conduct the ACA mission, as well as Air Expeditionary Force (AEF) and Theater Security Package (TSP) deployments on a regularly scheduled continuous cycle. Due to the increased use over recent decades, fourth-generation fighter aircraft assigned to these units are estimated to reach the end of their useful service lives by the year 2020.[8] Air Force and Air National Guard officials suggest that unless current fielding schedules or fourth-generation fighter aircraft service lives are somehow extended, a number of ACA sites will lack viable aircraft to effectively conduct ACA operations (Figure 1).[9]

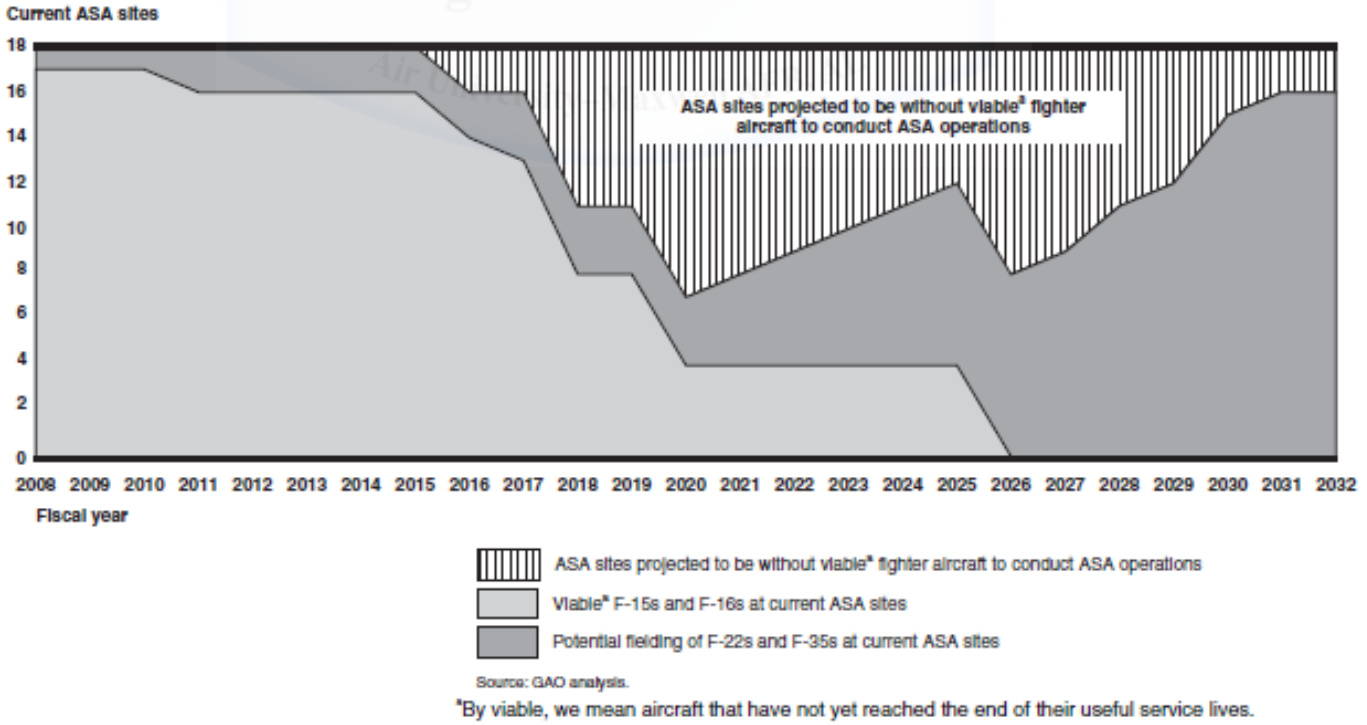


Figure 1: Projected Number With/Without Viable Aircraft to Conduct ACA.[10]

Military and elected officials have discussed several options that could reduce the potential gap between retiring fourth-generation fighter aircraft and the fifth-generation fighter aircraft replacing them. One option is to replace ACA tasked F-16s and F-15s with either F-22s or F-35s before fielding them to the Air Force Active Duty. This, however, would result in only 1 of 12 units receiving new aircraft before their fleets reach the end of their useful service lives.[11] Another option is to replace Air National Guard fourth-generation fighter aircraft with Air Force Active Duty fourth-generation fighter aircraft. Many of the Active Duty aircraft are experiencing the same structural problems and accelerated hours from use during overseas deployments as Air National Guard aircraft.[12] Some officials have suggested extending the service lives of fourth-generation fighter aircraft in an attempt to bridge the fighter gap. This would require a considerable allocation of additional military funding. If the United States intends to continue to deter, detect, and destroy threats posed against our homeland defense, the Air Force needs to address current and future fighter requirements now in order to ensure ACA mission sustainability.[13]

Research Methodology

United States military leaders continue to acknowledge that opposing state and non-state actors believe that asymmetric warfare poses the greatest challenges to the United States and its allies.[14] Through the application of problem/solution framework, this research paper will address how current fourth-generation fighter aircraft will address the evolving asymmetric threats. I will investigate the problems and key issues regarding asymmetric threats and how the Air Force intends to address these threats with the current fourth-generation fighter aircraft in place. Then, I will measure how other service branches are addressing their mission needs with similar aging

fourth-generation fighter fleets, while providing a statistical analysis of how mission success and failure rates are affected by aging aircraft. Next, I will investigate and identify potential fourth-generation fighter replacement alternatives. Lastly, I will provide a conclusion of the information gathered, create several recommendations, and provide my recommended best solution on how the Air Force should address the evolving asymmetric threats against our homeland defense.

Section II – Problem Description and Key Issues

Fourth-Generation Fighter Aircraft Sustainment Issues

Since the events of 9/11, the National Strategy for Aviation Security and U.S. intelligence officials have repeated the same theme year-after-year to the American people: aerial attacks are still a near and real threat to homeland defenses.[15] The United States Northern Command (USNORTHCOM) and NORAD have attempted to address these threats through the continuous manning of fully armed fighter aircraft strategically positioned throughout the United States, including Alaska and Hawaii.[16] Most of these alert sites have one central theme: fourth-generation fighter aircraft are dual tasked with conducting the ACA mission, as well as train and conduct AEF combat deployments on a regular basis. This increasing operational tempo has generated questions as to the capacity for sustainability and feasibility to continue the pace.

Almost two decades of war campaigns fought in Iraq and Afghanistan have expedited and shortened the lifespan of the Air Force fourth-generation fighter aircraft fleet as whole. Military and civilian leaders are confronted with the difficult task of determining how to generate fifth-generation fighter aircraft, while avoiding a fiscal overextension of military funding to address the age and airframe concerns of the current fighter fleets in place. With an estimated price tag of $160 million per aircraft and continually increasing production timelines, some experts believe military and civilian leaders are blinded by the F-35s capabilities and missing the necessary balance of force required to conduct the ongoing missions (Figure 2).[17]

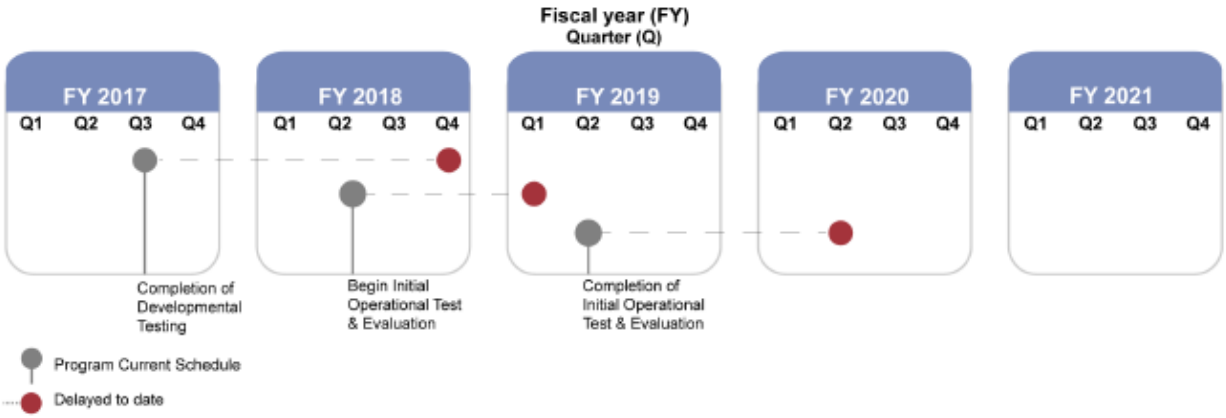


Figure 2: F-35 Developmental and Operational Test and Evaluation Anticipated Delays.[18]

Fighter Aircraft Replacement Gap

In 2009, a review performed by Director Davi M. D'Agostino of Defense Capabilities and Management, predicted a gap developing at ACA sites between retired fourth-generation fighters and the fifth-generation fighter aircraft set to replace them. Director D'Agostino and DoD officials believed that despite the Secretary of Defense's request to accelerate F-35 production, manufacturing problems and delays in testing programs would not close this gap.[19]

Air Force officials estimate that by 2026 no ACA sites will have viable aircraft in place to conduct the ACA mission.[20] These figures do not account for the required backfill at ACA sites while aircraft are taken away, unit transition periods once replacement aircraft are provided, or undergoing maintenance extension programs to any fourth-generation fighter aircraft.

Aside from fifth-generation fighter aircraft production and positioning at ACA sites, another problem exists: an increasing demand for fifth-generation aircraft to conduct missions overseas. Instead of conducting Close Air Support (CAS) missions over friendly controlled skies, the United States is now conducting missions over unfriendly occupied territories where Surface-to-Air Missile (SAM) systems can target fourth-generation fighter aircraft. Fifth-

generation fighters in places like Syria are not only necessary, but are crucial to the sustainability and survivability of the Americans conducting these missions.[21] The downing of an F-16 in the summer of 1995 over Bosnia was done by a less capable SAM system than what is being used today.[22]

Fourth-Generation Fighter Aircraft Shortfalls and Ineffectiveness

Designed for conventional battle against advanced opposing state actors, fourth-generation fighter aircraft have gained recognition through the global pursuit and destruction of terrorists. Senior Air Force officials continue to focus on the fielding and procurement of fifth-generation fighter aircraft, despite the low probability of engaging against advanced opposing state actors on a large scale.[23] Some experts believe this overemphasis of fifth-generation fighter aircraft procurement is generating an unbalanced fighting force and gap in Air Force capability.[24] This lack in capability and joint force operability is what some military experts describe as the "gunship effect".[25]

The gunship effect describes the joint characteristics and capabilities required from today's fighter aircraft in order to effectively prosecute attacks on modern battlefields.[26] The gunship effect creates a sense of superior situational awareness on the battlefield once a conventional opponent resorts to asymmetric attacks as force-on-force fails.[27] Homeland defense in the twenty-first century requires aircraft possess the ability to demonstrate the gunship effect in order to deny attacks from a variety of asymmetric weapons and platforms (e.g., remotely piloted drones).[28] Fifth-generation fighter aircraft possess the ability to demonstrate the gunship effect through their ability to target these non-traditional delivery platforms, specifically through the use of Active Electronically Scanned Array (AESA) radars, whereas the fourth-generation

fighter radars cannot.[29] The developing gap in fighter technology is creating a loss of the gunship effect within the homeland defense mission due to the United States military's continued pursuit of fifth-generation fighter aircraft.

Fiscal Constraints Affecting Homeland Defense and U.S. Air Sovereignty

The Air Force continues to develop and invest in fighter platforms that focus on being faster, more agile, and high-tech when compared to any other potential adversaries. This pursuit is generated from the military's desire to leverage U.S. airpower, project and protect air assets anywhere around the world at any given time.[30] Some experts suggest that the enemies faced today are a conventional fighting force and that the current generation of fighters cannot adequately defend against the enemy fighters about to be fielded.[31] Recent fifth-generation fighter aircraft produced by Russian and China continue to gain the attention of U.S. military officials.[32] Air superiority is a necessity in order to leverage airpower, but the military's pursuit of airpower might be creating a military readiness crisis for the fighter aircraft most likely to face our nation's next conflict: asymmetric warfare.

The Senate Armed Services Committee consists of a twenty-seven member bipartisan group responsible for passing the annual National Defense Authorization Act (NDAA), which authorizes the national defense spending for the military. The NDAA for fiscal year 2018 consists of $640 billion dedicated towards national defense spending.[33] This committee's central theme for this fiscal year is "…to help the U.S. military restore readiness, rebuild capacity, and modernize the force for future challenges."[34] Of the $640 billion in defense spending, $10.6 billion is allocated for procuring 94 Joint Strike Fighter aircraft.[35] Zero funding was listed for the modernization of fourth-generation fighter aircraft.

Congressman Michael Turner, Chairman of the House Armed Services Subcommittee on Tactical Air and Land Forces recently stated "…combined with years of budget driven national security strategies and cuts, rather than threat based strategies, have led to a military readiness crisis."[36] Congressman Turner also acknowledged how fourth-generation fighter aircraft play a crucial role in the near term as fewer than expected operational fifth-generation fighter aircraft are being made. He later identifies the driving force of this research paper by stating "Given current fiscal constraints, the military services are being forced to prioritize between building capacity in fourth-generation tactical aircraft inventory to help mitigate some of the immediate readiness burdens on the current force or trying to accelerate needed fifth-generation tactical aircraft capability."[37]

Section III – Criteria

The fourth-generation fighter aircraft's ability to address evolving asymmetric threats is brought into question by numerous contributing factors. Of these factors, four criteria serve as the driving factors to cause military and civilian leaders to question a fourth-generation fighter's ability to defend against asymmetric threats: mission incapable airframes, inadequate avionic systems, cost effectiveness of replacing fourth-generation fighter fleets, and mission readiness rates. Each of these four criterion will be considered during the alternatives section in order to provide viable options that can defend against asymmetric threats.

Mission Incapable Fourth-Generation Fighter Airframes

U.S. Air Force officials have considered several options to assist in overcoming fourth-generation fighter aircraft shortfalls. Of these options, extending the flight service hours is the one most seriously considered. In June of 2017, the Air Force Life Cycle Management Center (AFLCMC) publically released plans to contract for production of upgrade kits designed for the F-16 Service Life Extension Program (SLEP).[38] Through the modification and repair of flight critical structures, the SLEP process extends the F-16C/D's original life expectancy from 8,000 hours to more than 13,800 hours. The Air Force in unclear as to the desired number of F-16s it wants to SLEP, but insisted that the overall value of the SLEP contract would not exceed $403 million.[39] The Government Accountability Office (GAO) estimated in 2012 that 300 F-16 aircraft have an estimated cost of $2.81 billion, with SLEP work completed in the year 2011.[40] With the Air Force proposed SLEP budget of $403 million and 2012 estimates, only 40 F-16s would undergo the SLEP process.

Cost Effectiveness of Airframe and Avionic Replacement Plans

The Navy and Marines are facing the same fourth-generation fighter concerns as the Air Force. DoD originally planned on purchasing a total of 2,443 F-35s between 2008 and 2037, with 1,763 going to the Air Force and 680 going to the Navy and Marines.[41] However, the Navy and Marines are affected by the same F-35 program delays and increasing cost estimates as the Air Force. This has forced the Navy and Marines to consider other options.

In 2011, the Navy submitted a cost-benefit analysis to the DoD which implemented the SLEP to 150 existing F/A-18s, as well as a plan to purchase 41 new F/A-18s.[42] This plan was submitted into the fiscal year 2012 budget request and will allow the Navy to complete their SLEP plan by 2018, resulting in what Navy officials describe as "an acceptable inventory at a manageable level of risk."[43] Navy officials have said they will assess this plan annually and reserve the option to include up to 280 additional aircraft into the SLEP if necessary.

The NDAA for fiscal year 2018 authorizes the Navy and Marines to procure 24 F/A-18 Super Hornets at $1.9 billion and allows for the procurement of close to half the planned F-35s for the entire military.[44] The Navy's cost-benefit analysis of 2011 failed to be validated by an independent cost estimate and ultimately led to a loss of credibility for some decision-makers reviewing the estimate.[45] The GAO acknowledged this detail and insisted the Navy's cost estimate still demonstrated the four characteristics of a high-quality estimate: comprehensive, well-documented, accurate, and credible.[46]

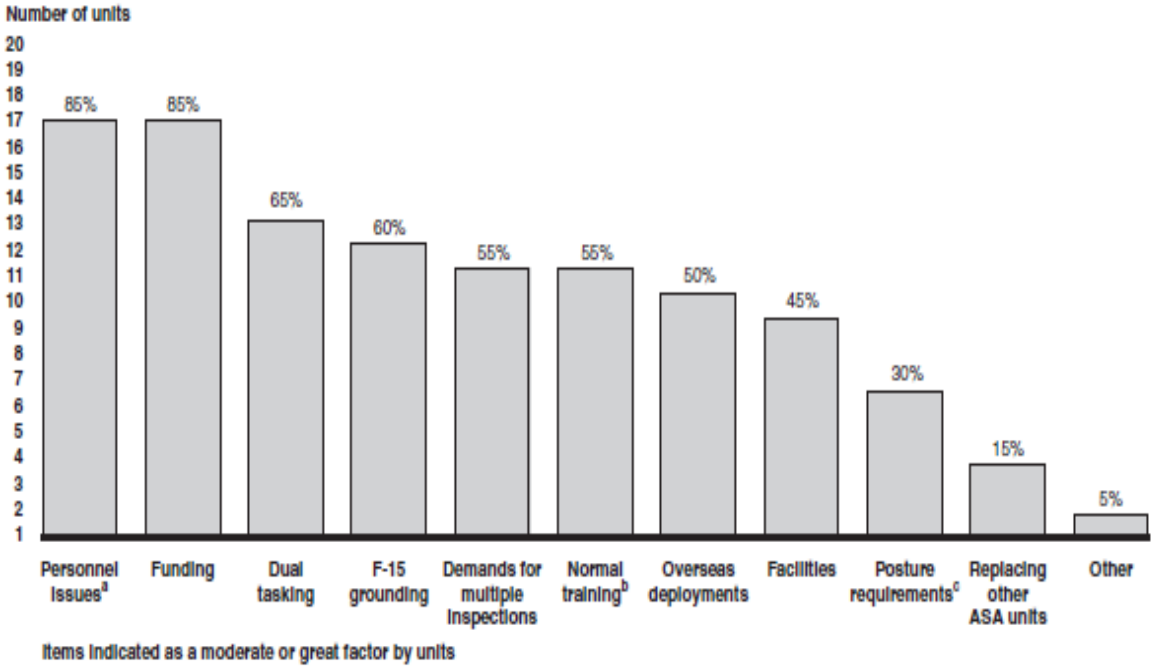
The Air Force and Navy have both decided that something must be done in order to bridge the fourth-generation fighter aircraft gap as the F-35 becomes sufficient enough to replace them. The Navy and Marines have developed a plan over the last several years which accounts for fourth-generation fighter aircraft modernization, the procurement of new fourth-generation

fighter aircraft with fifth-generation avionics, and the procurement of fifth-generation fighter aircraft to eventually replace their fleet of fourth-generation aircraft. The Air Force is continually updating its force structure plan to bridge fourth-generation fighter aircraft. Estimates began at 50 aircraft, increased to 350 aircraft, and eventually led some Air Force officials to suggest 650 aircraft undergo the SLEP.[47] The Air Force should develop a cost-benefit analysis; much like the Navy and Marines did in 2011 in order to produce an effective aircraft bridging plan.

Fourth-Generation Fighter Mission Readiness Rates

In 2002, NORAD declared ACA to be a steady-state air defense mission requiring Air Force major commands to report on the readiness of the alert missions.[48] NORAD partially assessed readiness while the Air Force assumed the overall responsibility for measuring readiness since it is the sole alert force provider. The lack of operational capability statements for units conducting the ACA mission has made it difficult for unit commanders to assess readiness.[49] Viewed as a contingency operation since the attacks of 9/11, ONE and the ACA mission continue to be viewed as a temporary mission by the DoD and Congress.[50] The temporary nature of ACA is restricting military and civilian leader's ability to properly make informed decisions regarding homeland defense operations and mission readiness rates.[51]

In past interviews, unit commanders have identified several key factors contributing to low mission readiness rates for ACA operations. Of these factors, the dual tasking of responsibilities to perform expeditionary missions and ACA operations was described one of the top challenges for unit commanders (Figure 3).[52] Many experts believe that assigning ACA operations as a steady-state mission to certain units would help mitigate some of these challenges and provide more stability to the DoD's "high-priority homeland defense mission."[53]



Source: GAO analysis of structured interviews with ASA units.

[a]Includes consideration of 2-year assignments, promotion opportunities, career progression, and other personnel issues as indicated by units.

[b]Normal training conducted for their warfighting mission.

[c]Can include the number and quality of aircraft and personnel that are on alert 24 hours a day, 365 days a year as well as other posture requirements.

Figure 3: Factors Identified as Impacting Units' Ability to Conduct ACA.[54]

Section IV – Fourth-Generation Fighter Alternatives

Secretary of the Air Force Heather Wilson, Chief of Staff for the Air Force General David Goldfein and Chief Master Sergeant of the Air Force Kaleth Wright published a collective list of what they considered to be the priorities for the Air Force in 2017. Their message calls to "…lead and support the Joint Force in defending our homeland…we will continue to face serious and ever-changing threats."[55] Of the five priorities listed, "restoring readiness to win and fight any time and to cost-effectively modernize to increase the lethality of the force" topped the list.[56]

The F-35 Lightning II is the premier next generation strike fighter aircraft of the U.S. military and a select number of international partners. With an estimated $400 billion in overall acquisition costs, averaging $12 billion a year through 2038, the DoD plans to procure a total of 2,433 F-35 aircraft.[57] In addition, the DoD estimates that the F-35's lifetime operational and maintenance costs will exceed $1 trillion (Figure 4).[58] Fourth-generation fighter alternatives should create solutions that can bridge the fighter gap by addressing the four criteria of: mission incapable airframes, inadequate avionic systems, cost effectiveness of replacing fourth-generation fighter fleets, and mission readiness rates.

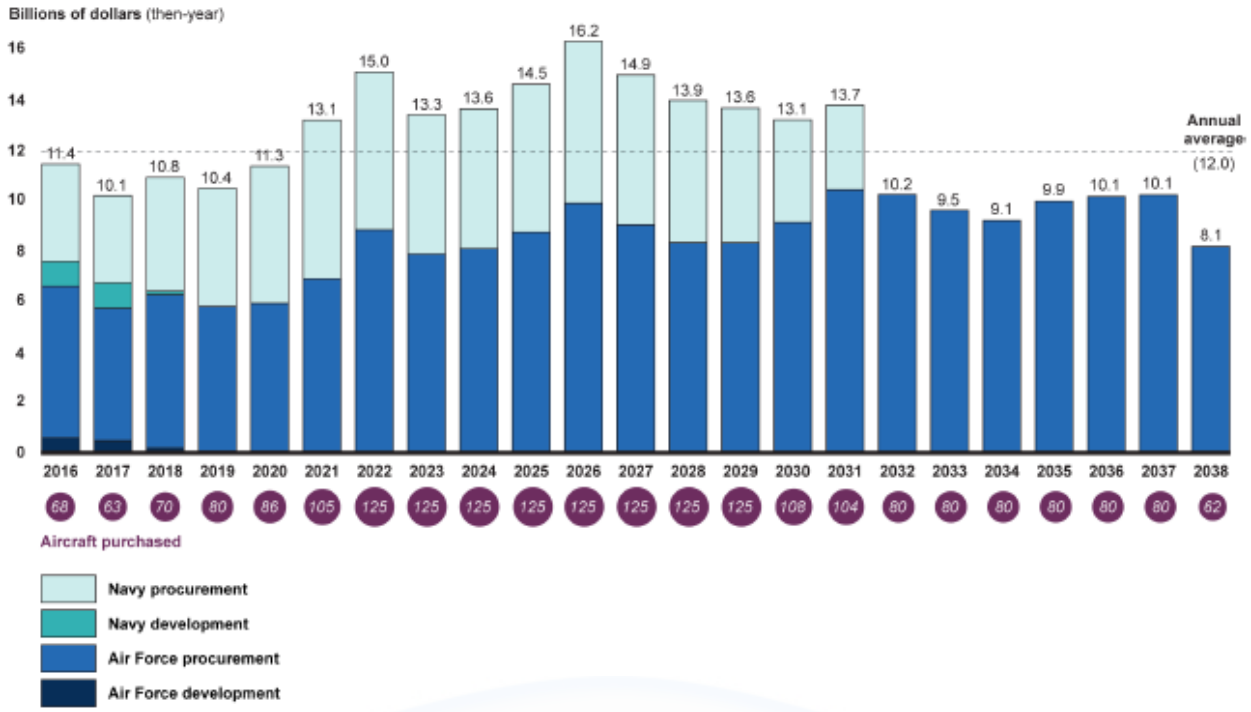


Figure 4: F-35 Budgeted Development and Procurement Costs by Service.[59]

Service Life Extension Program (SLEP) for Existing Fourth-Generation Aircraft

Fifth-generation fighter program delays and cost increases have forced civilian and military leaders to determine unique ways to maintain a viable fleet of fighter aircraft until the F-35 replaces them. Serving as a critical component to achieving and maintaining air dominance, as well as protecting the homeland, fourth-generation fighter aircraft SLEP upgrades provide a relatively cost-effective alternative solution to bridging the fighter gap.[60]

The Air Force is expected to receive 1,763 of the total 2,433 F-35's procured by the DoD between 2008 and 2037.[61] This translates into roughly a one-for-one replacement of fourth-generation fighter aircraft over the next twenty years. Initial Air Force plans are to SLEP and provide avionic upgrades to 300 fourth-generation fighter aircraft by 2020, with the potential to

SLEP an additional 650 aircraft if necessary.[62] Even if the Air Force approved plans to SLEP an additional 650 aircraft, nearly half of the fourth-generation aircraft are unaccounted for.

With an average cost of $10 million per aircraft, the SLEP for each F-16 creates an additional 2,000-3,000 lifespan hours and equates to 6 to 9 additional service years.[63] If the Air Force chose to SLEP 1,763 F-16's in an attempt to bridge fourth and fifth-generation fighters, approximately $15 billion would be spent over twenty years. Budgeting considerations for new radars should also be figured into modernization plans. New radars would fulfill the research criteria of replacing inadequate avionic systems by allowing fourth-generation fighter aircraft to track asymmetric targets.

Derived from fifth-generation fighter AESA radars, Northrop Grumman offers an APG-83 AESA radar that is specifically designed to fit inside an F-16's existing radar compartment and requires minimal aircraft modifications.[64] The APG-83 upgrade kit is approximately $2 million per aircraft or $3.5 billion to retrofit an entire fleet of 1,763 F-16s. The APG-83 provides numerous enhancements to the F-16, most important of these is small target detection.[65] Northrop Grumman claims these enhancements generate the confidence necessary for military and civilian leaders to trust that a fourth-generation aircraft "can remain operationally viable and sustainable for decades to come."[66]

With a combined modernization cost of close to $20 billion, the SLEP and avionic upgrades may not be the sole alternative in creating a fourth-generation fighter fleet that can address the evolving asymmetric threats for the foreseeable future. In 2009, the GAO recommended that the Secretary of the Air Force develop and implement a plan to address the projected capability gap at ACA units as a result of expiring useful service lives of fourth-generation fighter aircraft.[67] The 2018 NDAA and 2012 GAO SLEP report reveals a distinct

difference between each respective military branches plans for the projected capability gap.[6869] Air Force leaders should consider the Navy blended plan to SLEP and provide avionic upgrades to several of their existing fourth-generation fighters, while purchasing a number of new fourth-generation fighters equipped with fifth-generation avionic capabilities in order to better prepare for the fighter capability gap.

The Service Life Extension Program (SLEP) for existing fourth-generation fighter aircraft alternative addresses every research criteria listed. Placing the existing Air Force fourth-generation fighter fleet into the SLEP addresses the questionable service lives of the mission incapable airframes by extending them further into the future. The SLEP program's incorporation of avionic modernization plans also provide a solution to addressing the inadequate avionic systems that currently exist in fourth-generation fighters, granting them capabilities which are similar to those found in fifth-generation fighter aircraft. The criteria of cost effectiveness are met through the use and modification to existing Air Force inventory, which saves money by using the processes and systems in place. The SLEP alternative has a direct relationship with the improving mission readiness rates criteria, because without the SLEP fourth-generation fighter aircraft service lives would expire and create zero mission readiness rates.

Purchase New Fourth-Generation Aircraft

In June of 2017, Lockheed Martin announced its agreement with India to "produce, operate, and export F-16 Block 70 aircraft, the newest and most advanced version of the world's most successful, combat-proven multi-role fighter."[70] Working in cooperation with an Indian defense firm, Lockheed Martin seeks to create a cost effective fighter jet that can "maintain its

edge over China and Pakistan in the event of a conflict."[71] Retrofitted with modern avionics and improved overall structure design, India believes it can meet its national defense needs with fourth-generation fighters.

U.S. military experts have questioned whether modern avionic advancements in older aircraft designs can provide the security means necessary to ensure homeland security. In 2009, the Air Force assessed the cost-effectiveness of procuring new fourth-generation fighter aircraft in an attempt to bridge the fighter aircraft gap. The Air Force assessment concluded that the cost of procuring an entire new fleet of fourth-generation fighter aircraft was 10 times the amount of placing an existing fourth-generation fighter through the SLEP.[72]

Many experts agree that replacing an entire fleet of 1,763 F-16s with newer versions is not a viable solution to the fourth-generation problem, given the overall cost would be near $200 billion.[73] Creating a plan resembling the previously mentioned Navy fighter plan might be the best alternative to bridging the Air Force fighter gap.

The Navy's cost-benefit analysis conducted in 2011 provided a detailed plan to SLEP numerous existing F/A-18s (reserving the option to include up to 280 additional aircraft into the SLEP if necessary), a plan to purchase new F/A-18s in case F-35 replacements exceed the forecasted timeline, as well as allocate funding to purchase F-35s once made available. This analysis assists in providing a roadmap for leaders to use over several years, modifying and updating plans as details change.

The Air Force has fourth-generation fighter transition plans in place, but when compared to the Navy's transition plans the Air Force lacks the detail and realistic timelines necessary in order to ensure homeland defense coverage. Purchasing all new fourth-generation fighter aircraft to bridge the fifth-generation aircraft gap seems fiscally impossible. A balanced cost-benefit

analysis by the Air Force would assist in justifying the procurement of any new fourth-generation fighter aircraft as they incorporate a blend of SLEP fourth-generation fighter aircraft to bridge the fighter gap.

The alternative solution of purchasing an entirely new fleet of fourth-generation fighter aircraft addresses some of the proposed research criteria, while ignoring others. The criteria of addressing mission incapable airframes are met through the replacement of new and improved airframes, providing a service life for many years to come. Much like the SLEP alternative solution, the purchase of new fourth-generation fighter aircraft addresses the criteria of replacing inadequate avionic systems through the incorporation of AESA technology into new airframes. The mission readiness rates criteria would likely improve drastically after new airframes replace the over thirty year old models that require significantly more maintenance. Meeting the cost effectiveness criteria of replacing fourth-generation fighters with an entirely new fleet of aircraft is the greatest concern. An overall cost close to $200 billion does not seem like a realistic solution considering the amount of funding currently being directed towards the production and fielding of F-35s.

Purchase ACA Mission Specific Aircraft to Fulfill Homeland Defense Missions

Fiscal constraints brought on by heightened Federal spending have forced military and civilian leaders to consider many different homeland defense options. Government officials not only question a fourth-generation fighter's ability to address asymmetric threats, but whether fourth-generation fighter aircraft are the best airframe to conduct the ACA mission for the long-term.[74]

Textron Aviation Defense Company claims it has created an affordable surveillance and strike capable jet worthy of conducting homeland defense missions.[75] Scorpion aircraft features include: composite airframe, twin turbofan engines, tandem cockpit, retractable sensor mount, internal payload bay, and an external stores carriage for precision/non-precision munitions.[76] The Scorpion insists their future-proofing aircraft design allows for a wide range of mission sets, including future mission sets as threats evolve. Scorpion mission sets include: close air support, maritime security, aerospace control alert, tactical jet training, irregular warfare support, humanitarian assistance/disaster response, border security, counter narcotics, counter insurgency, forward air control-airborne, strike coordination armed reconnaissance, and airborne on scene commander.[77] I have discovered little information, data, or test flight evidence to reinforce the mission set claims made by Textron Aviation Defense Company officials.

Designed primarily for intelligence, surveillance, and reconnaissance missions currently taking place in Iraq and Afghanistan, the Scorpion uses common commercial technology and manufacturing to keep costs down.[78] With an anticipated 20,000 service life hours, an average cost of $3,000 per flight hour and a unit cost expected below $20 million, the Scorpion equates to approximately twice the amount of available service life hours and $7,000 per flight hour and $10 million a unit cheaper than an F-16.[79] With flight characteristics closely resembling the T-6 Texan training aircraft currently flown at Air Force Undergraduate Pilot Training bases, Textron Aviation Defense Company officials believe flight training costs would be kept to a minimum.[80] The Air Force pursued similar fully developed aircraft as replacement solutions, but similar to the Scorpion, these aircraft lacked data pertaining to the cost of sustainment.[81] In order to ensure accurate cost of sustainment estimates, the Air Force should conduct its own cost-benefit analysis in order to avoid contractor bias.

The Textron Aviation Defense Company openly admits the Scorpion is targeting the United States Air National Guard and foreign nations who cannot afford the F-35 or sustain the mission requirements placed on their fourth-generation fighter aircraft.[82] State, Federal, and military leaders continue to voice concerns over entering new programs that have an unproven track record as it relates to asymmetric warfare, ACA missions, counter narcotics, and air defense operations.[83]

Purchasing an aircraft specifically designed to conduct homeland defense answers some questions defined within the research criteria. Purchasing new aircraft would decrease the rate at which fourth-generation fighter aircraft would reach their usable service lives and significantly decrease the fighter gap. New airframes likely means an increase in mission readiness rates for homeland defense missions. The cost effectiveness criteria are brought into question with little defined data available pertaining to sustainment and training costs. The Scorpion fails address the avionic system criteria, as well as the overall research question of how an aircraft will address asymmetric threats facing our homeland defense. The Textron Aviation Defense Company makes several claims about the Scorpion aircraft being best suited for ACA, asymmetric types of missions. With no radar capabilities and only heat seeking air-to-air missile capabilities, the Scorpion fails to provide a reasonable solution that addresses the broad range of threats existing within the asymmetric realm. Some experts argue that Scorpion aircraft should conduct CAS missions overseas, decreasing the service life rates of fourth-generation fighter aircraft and fighter gap timeline.[84] That argument remains outside the scope of this research paper.

Assign ACA as a Unit's Primary Mission

The ACA mission has a longstanding history of the Air National Guard and Active Duty Air Force partnering together to ensure homeland defense over the last 50 years.[85] Consisting of adjutants general from each state conducting ACA missions as well as Air Force leadership from NORAD and USNORTHCOM, a well-defined partnership exists within the homeland defense command structure. Initially designed to serve as a reserve component to support Active Duty led missions, the Air National Guard has seen a steady increase in homeland defense responsibilities.[86] The Air National Guard is assuming the burden of supporting overseas contingencies more than ever before. Performing over 30 percent of the worldwide Air Force missions every day, the Air National Guard's usage far exceeds its original design of being a reserve component to the Active Duty during large scale wars and emergencies (Figure 5).[87]

TABLE 4

Air Force Major Units

	Active	Guard/ Reserve	Reserve Component (percent)
Air Offense Squadrons	9	3	25%
Air Force Squadrons	31	31	50%
Airlift Squadrons	21	39	65%
Air Refueling Squadrons	14	26	65%
Reconnaissance	21	5	19%
Space Squadrons	33	17	34%

Source: U.S. Department of Defense, Office of the Assistant Secretary of Defense for Readiness and Force Management, Total Force Planning and Requirements Directorate, *Defense Manpower Requirements Report, Fiscal Year 2015*, June 2014, p. 4, Table 1-3, http://prhome.defense.gov/Portals/52/Documents/RFM/TFPRQ/docs/F15%20DMRR.pdf (accessed August 14, 2015).

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Figure 5: Air Force Major Unit Reserve Component Percentages.[88]

Positioned to respond to Federal and State emergencies, the National Guard is the most logical choice to lead in a military role regarding homeland security. In order to adequately assume the role and responsibilities of homeland defense, many experts believe the Federal government should refocus the National Guard's primary mission to homeland security.[89] This change requires a refocus of combat support assets, annual dedication of Federal funding for

infrastructure, and redefined command structure that allows state Governors and their adjutant general's more control over their military forces.[90] The FY 2014 defense budget described "the primary [Operation Noble Eagle] cost driver is the mobilization cost of National Guard and Reserve Component personnel. These mobilized personnel provide force protection to key facilities within the United States and provide an increased air defense capability to protect critical infrastructure facilities and U.S. cities from unconventional attack."[91]

The Budget Control Act of 2011 imposed defense spending caps which reduced armed forces numbers despite an increasing need for operational missions globally.[92] In an inactivated status, Guard and Reserve component forces are far less expensive to sustain due to lower monthly entitlements compared to Active component forces.[93] The Active component's ability to maintain a full-time force allows a higher level of readiness to execute operational missions globally with minimal preparation. When given the appropriate time and resources to prepare, Guard and Reserve components have proven the same high level of results in overseas missions as evidenced by their performance in Iraq and Afghanistan.[94] Yet, from a financial and mission performance viewpoint, Active components are best served for overseas operations and Guard/Reserve components are best served for homeland operations.

Increasing overseas deployments over the last 20 years have Guard and Reserve components resembling the Active Duty more than ever. In 2014, the National Commission on the Structure of the Air Force revealed to Congress that "the Air Force should entrust as many missions to its Reserve Component forces because there is an irreducible minimum below which the Air Force cannot prudently cut Active Component end strength without jeopardizing warfighting capabilities, institutional health, and the ability to generate future forces."[95] This reduction in the Active Duty Air Force has created an 18 month AEF cycle for fourth-generation

fighter aircraft equipped Air National Guard units, further weakening an already overtasked Reserve force.

Air National Guard and Air Force Reserve fighter units have regularly deployed overseas and simultaneously maintained the ACA mission.[96] Competing requirements for AEF rotations and homeland defense missions have not only drastically reduced fourth-generation fighter service lives, but also "significantly reduced Air Guard unit training effectiveness and thus, its overall combat readiness."[97] Some civilian and military leaders have suggested Air National Guard fighter units solely support homeland defense missions, eliminating AEF commitments entirely.[98] Advantages to this approach are: simplifies training requirements by focusing a unit towards a specific mission, creates incentives for recruiting and retention of unit members as a result of not deploying, and it reduces the response time of those units called to assist in times of national emergencies.[99] Disadvantages include: further complicates AEF rotation schedule for overtasked Active and Reserve components, loss of deployable skillsets as units solely train to homeland defense missions, potential decrease in reenlistment rates due to a unit's inability to deploy, and a lack of deployable force flexibility to provide worldwide response coverage.[100]

Assigning ACA as a unit's sole mission partially addresses elements of research criteria, while creating issues for the Air Force as a whole. Eliminating a unit's responsibility to prepare and deploy for an AEF significantly reduces the timeline a fourth-generation fighter aircraft reaches its usable service life. This results in a relatively cost effective solution that allows units to train to a specific mission, imposing less hours on their existing fighter fleet and further minimizing the fourth-to-fifth generation fighter gap. Mission readiness rates would continue to steadily decrease and inadequate avionic systems would remain without a plan in place to implement a SLEP to existing fourth-generation fighter fleets.

Section V – Results

Based on these research findings, the United States military will experience significant challenges conducting homeland defense missions with the existing fourth-generation fighter aircraft fleet currently in place. Mission incapable airframes, inadequate avionic systems, cost ineffectiveness of replacing fourth-generation fighter fleets, and decreasing mission readiness rates are all contributing factors relating to reasons why fourth-generation fighter aircraft cannot address the evolving asymmetric threats facing our homeland defense. Failure to address the projected fourth-generation to fifth-generation fighter aircraft gap could leave the United States vulnerable to asymmetric attacks from opposing state and non-state aggressors. Therefore, it is necessary for Air Force officials to create and implement plans that address the fourth-generation to fifth-generation fighter gap and help ensure adequate sustained protection against homeland threats.

Each alternative solution addresses one or more of the criteria described as driving factors for a fourth-generation fighter's inability to defend against asymmetric threats. The SLEP for existing fourth-generation fighter aircraft alternative best addresses the research criteria listed. Airframe improvements and modifications made during the SLEP addresses many of the criteria, creating a direct positive effect on overall mission readiness rates. The incorporation of APG-83 upgrade kits into the SLEP provides a streamlined solution to the issue of inadequate avionic systems. The fourth-generation fighter SLEP provides the best and most cost effective alternative of the four alternatives researched. In order to assist in solving the fourth-generation to fifth-generation fighter gap and identify any future vulnerabilities against asymmetric attacks, this paper proposes a blended alternative approach be taken by civilian and military leaders.

Recommendations

Conduct and Update SLEP Cost-Benefit Analysis

The research conducted in this paper has revealed that unless fourth-generation fighter aircraft undergo SLEP, aircraft service lives will expire and create zero mission capable ACA manned sites.[101] Civilian and military leaders are severely hindered in their decision making due to a lack of updated cost estimates found through a SLEP cost-benefit analysis. I propose that an independent review be conducted that incorporates costs involving several different options. These options include: SLEP and avionic upgrade costs for the initially prescribed 300 fighter aircraft, expanded option of the maximum 650 fighter aircraft, and the overall cost estimate for every remaining fourth-generation fighter aircraft to undergo SLEP and avionic upgrades. These independent and unbiased estimates provide Congress and Air Force military leaders with the knowledge necessary as they create and develop the defense budget requests necessary that will ensure homeland defense protection measures are in place today and into the future.

Implement Airframe and Avionic SLEP to Existing Fourth-Generation Fighter Fleet

Upon completion of the fourth-generation fighter aircraft SLEP cost-benefit analysis, civilian and military leaders should create and update a realistic timeline regarding the expected fourth-generation to fifth-generation aircraft replacement at ACA sites. I propose the Air Force continue to move forward with plans to SLEP and provide avionic upgrades to their 300 fourth-generation fighter aircraft, invoke their option to SLEP the an 650 aircraft, as well as pursue options to SLEP more aircraft in the future. With a combined cost of approximately $12 million for SLEP and avionic upgrades per fourth-generation fighter aircraft, the Air Force creates a fiscally responsible solution to help minimize the fourth-to-fifth generation fighter gap.[102]

Purchase Limited Number of New Fourth-Generation Aircraft

Some fourth-generation fighters, non-SLEP and SLEP, will likely reach the end of their useful service lives prior to their fifth-generation fighter replacements reaching their intended destination. Aside from the original estimate of nearly 1,000 aircraft, Air Force leaders have little information available to know how many additional fourth-generation fighters can undergo SLEP. This, coupled with continuing fielding and production delays with the F-35, suggest Air Force leaders purchase a number of new fourth-generation fighter aircraft in order to confidently bridge the fourth-to-fifth generation fighter gap. I propose that the Air Force purchase enough new fourth-generation fighters to support the ACA mission in the event F-35s are not available at the time fourth-generation SLEP fighters reach the end of the service lives. Newly purchased fourth-generation fighters provide civilian and military leaders the flexibility continually reassess mission and aircraft priorities.

Reduce AEF and Overseas Deployments for ACA Assigned Units

Active Duty component cuts and reduction in force have made the Guard and Reserve components more relevant than ever. Increasing AEF rotations for fourth-generation fighter aircraft equipped Air National Guard units once assumed by the Active Duty Air Force have the Guard and Reserve operating at maximum capacity. Competing requirements for AEF rotations and homeland defense missions for dual tasked Air National Guard fighter units are forcing civilian and military leaders to determine ways to keep these units intact. I propose those Air National Guard fighter units assigned the ACA mission be placed on a 36 month AEF cycle, with non-ACA mission assigned units deploying either for longer durations or more regularly.

This change to the AEF cycle would decrease the rate in which fourth-generation fighter aircraft reach their maximum service lives, while allowing ACA units to refocus more attention towards their primary mission: homeland defense.

The implementation of these recommendations will create a plan that addresses mission incapable fourth-generation fighter aircraft, inadequate avionic systems on these aircraft, cost effective plan to improve or replace fourth-generation fighter fleets, and a plan to improve overall Air Force mission readiness rates. Sound planning and preparation will ensure fourth-generation fighter aircraft can adequately address evolving asymmetric threats, creating a secure homeland defense system.

Conclusion

The 9/11 attacks revealed that the United States 'No-Fail' homeland defense mission was not prepared for asymmetric attacks. Aging Air Force fourth-generation fighter airframes and avionics systems are causing civilian and military leaders to question their ability to defend against future asymmetric attacks. Air Force officials must develop a plan to address these homeland security questions.

In order to ensure appropriate measures are in place to promote homeland security, civilian and military leaders must first conduct a fourth-generation fighter aircraft SLEP cost-benefit analysis that can assist developing a plan to SLEP existing fighter fleets. Outdated cost estimates and underestimated aircraft SLEP numbers have created a lack of credible information for civilian and military leaders to determine the best solution to the fourth-generation fighter problem. The Navy's SLEP cost-benefit analysis has proven to be beneficial in their pursuit to bridge the fourth-to-fighter generation fighter gap, the Air Force should model their analysis in a similar manner.

In the event the F-35 cannot replace fourth-generation fighter aircraft at ACA sites, the Air Force needs to develop a plan to purchase new fourth-generation fighter aircraft. New fourth-generation fighters provide the reinforcements necessary in the event legacy fourth-generation fighters surpass their extended service lives. A reduction in deployments for dual tasked ACA units would also decrease the rate in which fourth-generation fighters reached their useful service lives, further reducing the fourth-to-fifth generation fighter gap. These steps, along with continued research, will create a higher level of preparedness to counter asymmetric attacks against the United States.

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